

**REMARKS**

Claims 14, 18, 21, 28, 29, and 31-33 are pending, with claims 14, 18, and 21 being independent. Claim 21 has been amended to even more clearly recite and distinctly claim Applicants' invention and to pursue an early allowance. Support for the amendment can be found in the original claims as well as throughout the specification. Therefore, no new matter has been added. Without prejudice to or disclaimer of the subject matter contained therein, claim 30 has been canceled in order to expedite prosecution.

Applicants respectfully request the Examiner to reconsider and withdraw the outstanding rejections in view of the following remarks.

***Claim Rejections under 35 U.S.C. § 103***

Claims 14, 28, 29, 34, and 35 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 5,384,009 (referred to herein as "Mak"). Claim 18 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mak in view of U.S. Patent No. 4,208,241 (referred to herein as "Harshbarger"). Claims 21 and 30-33 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mak. Applicants respectfully traverse these rejections.

Claim 14 recites an oxygen-free plasma etching gas formulation for removing an organic ARC on a metallic layer comprising  $\text{CHF}_3$ , argon and  $\text{HCl}$  or  $\text{BCl}_3$ , the gas formulation being free of  $\text{SF}_6$ . Claims 28 and 29 depend on claim 14 and thus recite additional features and claims 34 and 35 have been canceled.

Claim 18 recites an oxygen-free plasma etching gas formulation for removing an organic ARC on a metallic layer comprising  $\text{CHF}_3$ , argon and chlorine, the gas formulation being free of  $\text{SF}_6$ , and a ratio of flow rates of  $\text{CHF}_3$ :argon:chlorine in the formulation is 5 to 80 sccm:5 to 80 sccm:5 to 60 sccm.

Claim 21 recites an oxygen-free plasma etching gas formulation for removing an organic ARC on a metallic layer comprising (i) more than one fluorine-containing compound, (ii) an inert carrier gas selected from the group consisting of argon, neon,

helium, and mixtures thereof, and (iii) chlorine, the gas formulation being free of SF<sub>6</sub>.  
Claims 30-33 depend on claim 21 and thus recite additional features.

### **FACTUALLY SUPPORTING A *PRIMA FACIE* CONCLUSION OF OBVIOUSNESS**

It is well established that the examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. MPEP § 2142. Further,

[A]ssertions of technical facts in the areas of esoteric technology or specific knowledge of the prior art must always be supported by citation to some reference work recognized as standard in the pertinent art. *In re Ahlert*, 424 F.2d at 1091, 165 USPQ at 420-21. See also *In re Grose*, 592 F.2d 1161, 1167-68, 201 USPQ 57, 63 (CCPA 1979) ("[W]hen the PTO seeks to rely upon a chemical theory, in establishing a *prima facie* case of obviousness, it must provide evidentiary support for the existence and meaning of that theory."). MPEP § 2144.03.

However, the Advisory Action mailed January 22, 2004, asserts without factual support that: (i) the ionization potential of Xe and other noble gases are of the same order of magnitude and (ii) modifying Mak's Xe with an inert gas such as Ar would have been obvious because noble gases are known to include helium, argon, or nitrogen, neon or xenon, which are used as carrier and diluent gases; hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to replace Mak's xenon with argon since both gases are seen as equivalent in that they belong to the same chemical family and possess the same chemical properties, and hence, substitution of one for the other would have been obvious for the purpose of providing an inert carrier gas.

As explained below, the evidence submitted herewith establishes that (1) the ionization potential of xenon and argon are substantially different and (2) xenon and argon are not equivalent in some plasma etch processes.

Mak (assigned to Applied Materials, Inc.) discloses a process for selectively etching a substrate having grain boundaries and a resist material thereon. Mak discloses a process gas that comprises xenon. Mak discloses that in plasma etch processes, it is desirable for the process gases to have a low ionization potential so that less energy is required to ionize

the gases (Column 1, Lines 60-62). Mak discloses that the process gases have low ionization potential (Column 2, Lines 9-17).

U.S. Patent No. 6,200,433 (also assigned to Applied Materials, Inc. and referred to herein as "Ding"), a copy of which is attached for the Examiner's convenience, establishes that xenon and argon are not equivalent. Ding discloses that Kr and Xe have molar masses substantially greater than conventional plasma gases such as Ar and helium (Column 5, Lines 47-53). Ding further discloses that Xe and Kr have lower ionization energies than conventional plasma gases, in particular Ar and He and that while argon, helium and other conventional plasma gases are currently being used because of their low cost, such gases have high ionization energies and thus require relative more energy to be ionized than Xe or Kr (Column 6, Lines 10-31).

U.S. Patent No. 6,544,429 (also assigned to Applied Materials, Inc. and referred to herein as "Hung"), a copy of which is attached for the Examiner's convenience, discloses that in some types of metal etching based on chlorine chemistry, such as discussed in U.S. Patent No. 5,384,009 to Mak, xenon is preferred (Column 5, Lines 37-45). Hung further discloses the use of xenon as a diluent gas and states that while krypton promises similar effects, xenon demonstrates a substantially different behavior from argon when used as a diluent gas (Column 6, Lines 50 – Column 8, Line 56).

Accordingly, Applicants respectfully submit that (1) a *prima facie* conclusion of obviousness has not been factually supported in the Official Action and (2) the evidence submitted herewith warrants a conclusion that the claimed invention is patentable over Mak. Ding discloses that xenon and argon do not possess the same chemical properties (i.e., molar mass and ionization energy), and establishes that there is an art recognized significant difference in ionization energies between xenon and argon. Hung establishes that xenon exhibits substantially different behavior than argon. In light of Ding and Hung, Applicants respectfully submit that one of ordinary skill in the etch art would not consider xenon and argon to be equivalent.

**THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART  
UNSATISFACTORY FOR ITS INTENDED PURPOSE**

As explained in MPEP § 2143.01, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Mak discloses a process gas having xenon to provide low ionization potential so that less energy is required to ionize the gases and high selectivity can be achieved. Ding discloses the significance of the difference in ionization energies between xenon and argon and Hung establishes that xenon exhibits substantially different behavior than argon. Accordingly, Applicants respectfully submit that there is no suggestion or motivation to replace the xenon of Mak with argon, as the proposed modification would render the Mak etch gas unsatisfactory for its intended purpose.

**THE PROPOSED MODIFICATION CANNOT CHANGE THE PRINCIPLE OF  
OPERATION OF A REFERENCE**

As explained in MPEP § 2143.01, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Again, Mak discloses a process gas having xenon to provide low ionization potential so that less energy is required to ionize the gases and high selectivity can be achieved. Ding discloses the significance of the difference in ionization energies between xenon and argon and Hung establishes that xenon exhibits substantially different behavior than argon. Accordingly, Applicants respectfully submit that the teachings of Mak are not sufficient to render the claims *prima facie* obvious, as replacing the xenon of Mak with argon would change the principle of operation of the process gas of Mak.

**APPLICANTS MAY PRESENT EVIDENCE SHOWING THERE WAS NO  
REASONABLE EXPECTATION OF SUCCESS**

As explained in MPEP § 2143.02, obviousness requires at least some degree of predictability. Evidence showing there was no reasonable expectation of success may support a conclusion of nonobviousness. *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976).

Because Mak seeks to benefit from the low ionization potential of xenon, so that less energy is required to ionize the gases and high selectivity can be achieved, there would be no reasonable expectation of success using argon, having a significantly higher ionization potential. Ding discloses the significance of the difference in ionization energies between xenon and argon and Hung establishes that xenon exhibits substantially different behavior than argon. Accordingly, Applicants respectfully submit that there is no reasonable expectation of success in replacing the xenon of Mak with argon, and accordingly, a *prima facie* case of obviousness has not been established.

***Summary***

Applicants respectfully submit that Mak, or Mak in view of Harshbarger, does not disclose or suggest the presently claimed oxygen-free plasma etching gas formulation for removing an organic ARC on a metallic layer. Specifically, Mak and Mak in view of Harshbarger do not suggest an oxygen-free plasma etching gas formulation for removing an organic ARC on a metallic layer comprising argon or an inert carrier gas selected from the group consisting of argon, neon, helium, and mixtures thereof. Accordingly, withdrawal of the rejections under 35 U.S.C. § 103(a) is respectfully requested.

***Conclusion***

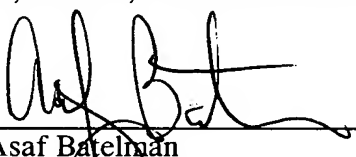
For the reasons noted above, the art of record does not disclose or suggest the inventive concept of the presently claimed invention as defined by the claims.

In view of the foregoing remarks, reconsideration of the claims and allowance of the subject application is earnestly solicited. The Examiner is invited to contact the

undersigned at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted,

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